

C-AD Access Training



LEARNING OBJECTIVES

(Why take this course?)

- Unescorted Access into Primary Areas
- Unescorted Access into Experimental Areas
- Conventional & Radiological Safety Hazards
- Response to emergencies
- Equivalency for **Oxygen Deficiency Hazard (ODH)** Training
(for access to ODH Class-0 areas at C-AD ONLY)

Note: Successful completion of this course does not allow you to:

- work in Contamination Areas
- remove activated materials and place them in uncontrolled areas
without the assistance of a Radiological Control Technician (RCT)
- work on-or-near energized electrical equipment without additional
laboratory training, C-AD approvals and PPE
- handle hazardous materials/chemicals without additional laboratory training

C-AD Conduct of Operations

(Agreement with DOE)

- Written procedures exist for most operations
- Use of qualified and trained personnel
- Appropriate authorizations and work permits before starting a job
- Definitive lines of authority
 - On-duty Operations Coordinator is responsible for the safe operation of accelerator complex during operating periods (x4662)
 - Maintenance Coordinator is responsible for safe operation and coordination during shutdown periods

ACCESS CONTROL SYSTEM
(Accelerator)

Or

PARTICLE ACCELERATOR SAFETY SYSTEM (PASS)
(Collider and NSRL)

PROHIBITED ACCESS

CONTROLLED ACCESS

RESTRICTED ACCESS

ACCESS CONTROL SYSTEM

At AGS, Booster, transfer lines, Bldg 912 target caves ...etc:

- Designed for Radiation Protection
- “O” or “256” key used during Restricted Access
- One Key / One Access

PARTICLE ACCELERATOR SAFETY SYSTEM (PASS)

At RHIC / NSRL:

- Designed for Radiation Protection
- At RHIC, also designed to give Oxygen Deficiency Warning
- Card-key used during Restricted Access
- One Key / One Access

PASS Control Panels

Typical style for RHIC and NSRL



Red

Yellow

Green



STAR Gate

Particle Accelerator Safety System (PASS) Cards

During RESTRICTED ACCESS Mode:

To enter, place PASS access card on card reader, get green light on reader, open door.

To exit, turn knob to open door (card key not required to exit).



Controlled Access Mode

During CONTROLLED ACCESS mode:

- Personnel going in AND out of the Primary Area are being tracked (accounted-for)
- You must coordinate your entry AND exit with the Main Control Room gate-watch

QUESTION: In going from "Restricted Access" mode to "Controlled Access" mode, what essential and most reliable action is taken to assure that the Primary Areas are cleared of personnel?

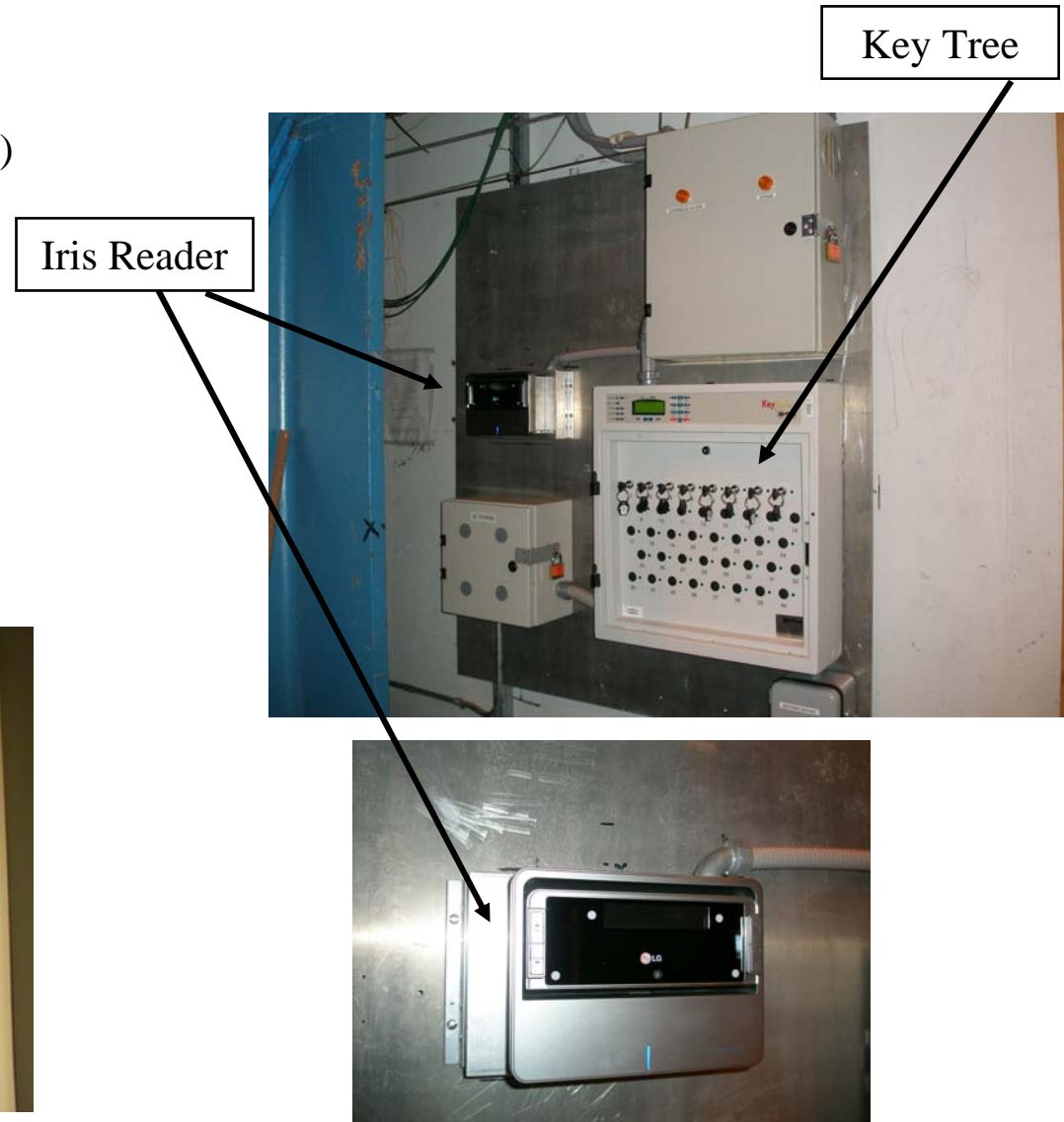
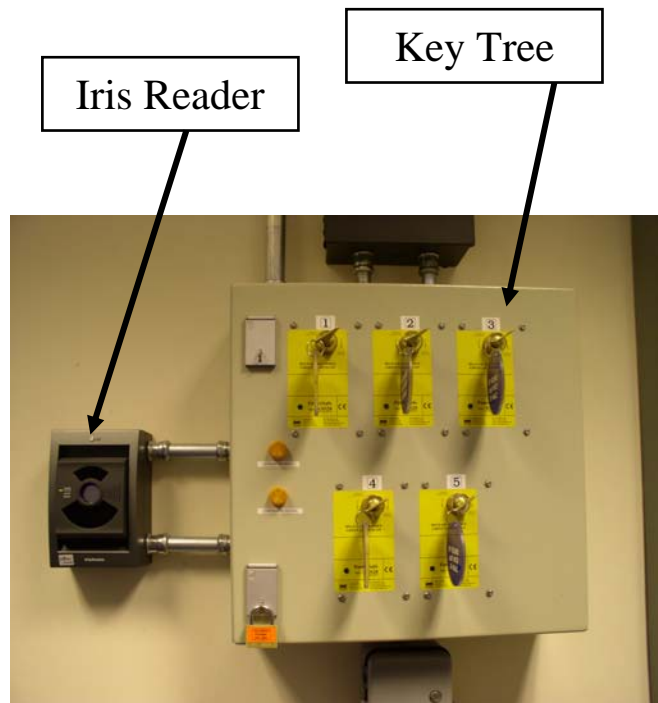
ANSWER: The Primary Areas are physically walked-down and visually inspected (a "sweep" is conducted)

Examples of key-tree arrangements for entry/exit during Controlled Access Mode at RHIC

(Used to control and monitor entry/exit from experimental Intersection Regions)

- Have iris registered
- Pull key from key tree
- Contact MCR (for entry AND exit)
- Be observed by video (during entry and exit)
- Return key to key tree

ONE KEY - ONE ACCESS !



Controlled Access Mode

Increased electrical hazard:

During Controlled Access Mode, much more electrically powered equipment is energized (versus in Restricted Access Mode), and this typically requires that you have specific electrical safety training* for entry.

* Training for working on-or-near energized conductors.

GATES ARE LOCKED AND EXIST FOR RADIATION & ODH PROTECTION



- You are the person most responsible for your safety. Use common sense. Never assume you know all the hazards.
- DO NOT attempt to enter primary areas immediately following a power failure; CONTACT MCR FIRST.
- Follow POSTINGS. Activation checks required in most areas.
- DO NOT tamper with access gates or other access control system components.

Access Control Modes - Summary

Green Light - RESTRICTED ACCESS

To enter: Use card-key (e.g.: at RHIC, NSRL) or “O” key or “256” key.

To exit: Turn knob on door

Yellow Light - CONTROLLED ACCESS

Main Control Room (MCR) controls & monitors access.

To enter: Call / coordinate with MCR !!

To exit: Call / coordinate with MCR !!

Enter and exit through same gate

You are being accounted-for in this mode

Red Light - ACCESS PROHIBITED

This mode means that beam is on
or is about to be turned on.

Access is PROHIBITED

Beam Imminent Alarm Signals

At AGS, Booster, SEB target rooms ... etc:

Overhead lights go off or are dimmed, Audible Announcement.



Transfer tunnel:

Orange Strobe, Audible Announcement



At RHIC:

Orange Strobe, Audible Alarm

Note: When entering tunnels, bring a flashlight

Examples of Crash Cord in RHIC Intersection Regions (IR)



RADIATION WORK PERMITS (RWP)

Either a General or Job Specific RWP is required for entry into any posted Radiation Area, High Radiation Area or Contamination Area

- Job Specific RWP required for jobs or entries into areas predicted to cause greater than:

20 mrem to an individual

or

200 person-mrem to a work crew

- Job Specific RWP also required for jobs that may alter radiological conditions or involve unpredictable radiological hazards
- Individuals signing on to a RWP must read the RWP and are signing that they are aware of, and will comply with, the requirements of the RWP

C-AD “General” RWP for RADIATION AREAS

For routine-type entry into Radiation Areas throughout C-AD (not an area-specific RWP)

Valid for the 1-year term stated on the RWP

Sign-in locations:

- C-AD Bldg 911 Training Office
- C-AD Health Physics Trailer

BNL RADIOLOGICAL WORK PERMIT (RWP)			
RWP # 07-01			
RWP Type: <input type="checkbox"/> Job Specific <input checked="" type="checkbox"/> General		Start Date 08/01/07 End Date 07/31/08 Revised End Date _____	
Shaded area 1 through 6 to be completed by requester / initiator			
1. Initiator: Ray Karol	2. Life #: 15065	3. Phone #: 5272	4. Bldg.: 911A
5. Job Location: Posted Radiation Areas at the Collider-Accelerator Department – See SI (1).			
6. Job Description: Routine Entry for inspections, Data Collection, Tours, and Routine Work Activities Performed by a System Specialist.			
7. Radiological Concerns: (e.g. Primary radionuclides, high dose rate, airborne) N/A			
8. Conditions that will void RWP: None			
9. Job Review:	10. Estimated Dose: (mrem)	11. Attachments:	12. Training Requirements:
<input checked="" type="checkbox"/> Pre-Job Review	Highest Individual 20 mRem	<input checked="" type="checkbox"/> Radiological Survey Form (Posted locally)	<input checked="" type="checkbox"/> Radiation Worker (RWT 002)
<input type="checkbox"/> ALARA Review	<input type="checkbox"/> Per-Job	<input type="checkbox"/> Technical Work Document	<input type="checkbox"/> RBA Practical (RWT 002A)X
<input type="checkbox"/> Pre-Job Brief	<input checked="" type="checkbox"/> Per Entry	<input checked="" type="checkbox"/> TWD#	<input type="checkbox"/> Contamination (RWT 300 / 300A)
<input type="checkbox"/> Post-Job Review	Collective 200 mRem	<input checked="" type="checkbox"/> Other: Pre Job Review	<input type="checkbox"/> Benchtop/dispersibles (RWT 500)
<input type="checkbox"/> Other	<input checked="" type="checkbox"/> Per Job	<input type="checkbox"/> C-A OPM-ATT 9.5.4a	<input checked="" type="checkbox"/> Other: Applicable C-A Facility Specific Training, (C-A Access, Radiobiology or Collider User) in addition to Radiation Worker I See SI (3)
Work Control Coordinator to consult with Building Manager and/or Supervisor when assigning tasks.		<input type="checkbox"/> Not Applicable	<input type="checkbox"/> Not Applicable
See SI (2)			
13. Work Controls:	14. Protective Equipment:	15. Dosimetry:	16. Check Out Instructions:
<input type="checkbox"/> FS Coverage	<input type="checkbox"/> Gloves	<input checked="" type="checkbox"/> TLD	<input type="checkbox"/> Bioassay
<input type="checkbox"/> Intermittent	<input type="checkbox"/> Shoe Covers	<input type="checkbox"/> Self-Reading Dosimeter	<input type="checkbox"/> Whole Body Count
<input type="checkbox"/> Continuous	<input type="checkbox"/> Booties	<input type="checkbox"/> Alarming Dosimeter	<input type="checkbox"/> Urine Sample
<input type="checkbox"/> Pre-Job Briefing	<input type="checkbox"/> Coveralls	<input type="checkbox"/> Finger Dosimetry	<input type="checkbox"/> Pre-Job
<input type="checkbox"/> Limiting Conditions	<input type="checkbox"/> Respirator	<input type="checkbox"/> Not Applicable	<input type="checkbox"/> Post-Job
<input checked="" type="checkbox"/> Hold Points See SI (4)(5)	<input type="checkbox"/> Head Cover		<input type="checkbox"/> Contamination Check
<input type="checkbox"/> Air Monitoring	<input checked="" type="checkbox"/> Not Applicable		<input type="checkbox"/> Personnel Frisk
<input type="checkbox"/> Shielding			<input type="checkbox"/> PCM
<input checked="" type="checkbox"/> Other See SI (6)			<input type="checkbox"/> Equipment Tools
<input type="checkbox"/> Not Applicable			<input type="checkbox"/> Post Job Survey
			<input type="checkbox"/> Not Applicable
			<input checked="" type="checkbox"/> Activation Check
Many Locations Require Activation Checks Prior to Removing Items from Area. Read and Follow All Postings.			
17. Expected Radiological Conditions			
Radiation <input type="checkbox"/> N/A		Surface Contamination <input checked="" type="checkbox"/> N/A	
General Area: See posted survey	Removable: N/A	Airborne Radioactivity <input checked="" type="checkbox"/> N/A	
On Contact: See posted survey	Removable: N/A	Nuclide Concentration	
Gamma <input type="checkbox"/> Neutron <input type="checkbox"/>	Removable: N/A	dps/100cm ⁻² Alpha	
Beta <input type="checkbox"/> Check all that apply	Total: N/A	dps/100cm ⁻² Beta/Gamma	
	Total: N/A	dps/100cm ⁻² Tritium	
		dps/100cm ⁻² Alpha	
		dps/100cm ⁻² Beta/Gamma	
18. Special Instructions (Hold Points, Limiting Conditions, Special Dose Limits, etc.) (SI): (Including Facility Specific Training)			
(1) Refer to C-A OPM-ATT 9.5.4a for a listing of permanent Radiation Areas. Due to the transient nature of many Radiation Areas at C-A there will be some that may not be listed on this attachment but may be covered under this RWP. <u>Read and follow all postings.</u>			
(2) No single entry shall result in more than 20 mR. Multiple entries shall not result in more than 20 mR per person per job. If pre-job dose estimates exceed 20 mR per person a Job-Specific RWP is required.			
(3) A trained and authorized C-A escort in accordance with C-A OPM 2.16 may escort visitors.			
(4) Consult with Facility Support Staff prior to starting any job in the U-line Neutrino Blockhouse (LANL, proton radiography).			
(5) This RWP is not for work in Radiation Fields > 100 mR hr ⁻¹ . Handling or exposure to tritiated water, Unapproved alterations of radiation barriers, or for work with the potential to disperse or generate radioactive contamination.			
(6) Review appropriate radiological survey prior to commencing work. The sign-in log for this RWP is located in the 911A Training Office, and the Health Physics Field Office after normal working hours			
19. Approvals	Signatures	Life Number	Date
Initiator		15065	
Facility Support Representative		19773	
Department (As Required)		14255	
20. Close Out Signatures FS Rep.			

C-AD RWP for High Radiation Areas & Contamination Areas

RWP ACCESS CONTROL LOG

Each High Radiation Area &
Contamination Area has RWP at
entrance.

Must log into, and out of, the RWP
once per day as a minimum.

Signature and dose information
(SRD readings) are required.



RWP ACCESS CONTROL LOG

Log in AND out once per day as a minimum

There should be NO BLANK SPACES when you are finished logging out

NEW column:
"I have a
flashlight"



C-A RWP Access Control Log*

EWP# _____

RWP # _____

Location valid for this RWP/EWP :

I am qualified in C-A Access training	I will wear my TLD And a Digital Alarming SRD	I have reviewed my estimated Dose Limits indicated on the RWP	Print Name	Signature	Individual Under Escort	Life Number	Date	Time In	Time Out	Dosimeter Number	** SRD Calibration Due Date	SRD Reading Pre	SRD Reading Post	Net-SRD Reading
INITIAL	INITIAL	INITIAL			Y / N									

* This sign in log must be completed once for each job or once each day for multi-day jobs – NO EXCEPTIONS

* Signing this sign-in log indicates that you have read, understood and will comply with the RWP and EWP prior to initial entry to the area and after any revisions.

** **If dosimeter calibration due date has passed, DO NOT ENTER POSTED AREA. Obtain a new dosimeter that is in calibration.**

CAUTION: Changes in Job Scope or in Radiological Conditions will void this RWP. Consult the Radiological Control Division Facility Support Representative for direction.

SELF READING DOSIMETER (SRD)



- Digital SRDs are required in High Radiation Areas

- Efficient for Gamma dose

- The C-AD Training Office can provide you with instructions on how to operate the SRD (e.g.: turn on, turn of, re-zero)

- SRDs are set to alarm at a certain:

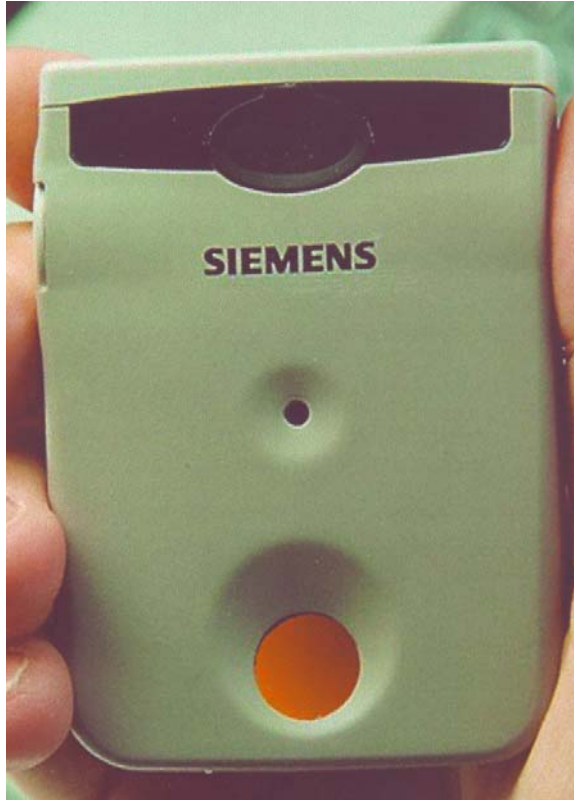
total accumulated dose (e.g.: 18 mrem), and

dose rate (e.g.: 90 mrem/hour)

Set points may be changed by Health Physics as appropriate



How to respond ...



If while in a High Radiation Area your Self-Reading Dosimeter (SRD) starts alarming or the chirp rate increases unexpectedly:

- stop work and place work area in a safe condition
- notify others in the work area
- immediately exit the area
- notify a C-AD Radiological Control Technician and your supervisor - - your TLD badge may need to be read-out immediately

Price-Anderson Amendments Act (PAAA)

Failure to comply with radiological rules or other safety rules, or failure to identify and report non-compliances to the Department of Energy (DOE), subjects the Laboratory to enforcement action.

Worker responsibilities include:

- Comply with requirements
- Report non-compliances
- Obey Stop Work Orders

WARNING

Willful or flagrant disregard of Federal Radiation Protection Rules or other Safety Rules may results in disciplinary action.

RADIOLOGICAL AREA DEFINITIONS

Controlled Area -- any area where access is controlled due to the presence of radiation above natural background levels or due to the presence of man-made radioactive materials. As a minimum, these areas are posted “Controlled Area.”

Radiation Area -- any accessible area where an individual may receive a whole-body dose greater than 5 mrem in one hour at 30 cm (1 ft). As a minimum, these areas are posted “Radiation Area, TLD Badge Required.”

High Radiation Area -- any accessible area where an individual may receive a whole-body dose greater than 100 mrem in one hour at 30 cm (1 ft). As a minimum, these areas are posted “Danger, High Radiation Area, TLD Badge and SRD Required.”

PRIMARY BEAM

DO NOT ENTER PRIMARY AREAS IMPROPERLY!

Example: in-beam dose rate may be
100,000,000,000 rem/hr for proton beam

Normal Operations: 1 to 2 mrem outside shield.

Faults: No more than 20 mrem per fault outside shield.

Residual activity: Inside primary areas up to several 10's of rems in some spots. In most cases, Health Physics makes first entry for survey following beam-off. Contact MCR before first entry.

Other: Air activation, activated cooling water, activated soil near beam stops.

DANGER



**HIGH RADIATION
AREA**

WITH BEAM ON

ENTRY REQUIREMENTS

TLD AND RWP
SUPPLEMENTAL DOSIMETER
CONTACT MCR x4662

ACTIVATION CHECK REQUIRED

RADIOACTIVE MATERIALS AREA



This posting means you must not release items from the area without having the items checked for activation.

Contact the Health Physics office to perform activation check.

Air Activation

Air activation at the accelerators may reach 100's mrem/hr from airborne radioactivity inside target caves for several minutes post shutdown (beta, gamma).

During running periods, air activation may exist outside target caves:

- but requires no special protection unless instructions are posted at the work area
- decays within minutes after the beam is turned off
- can be reduced by using solid doors or other special barriers

Note: This information regarding target caves applies mostly during operation of high intensity proton beam at the AGS complex. This has not occurred in recent years.

Remember: In most cases, Health Physics makes first entry into a Primary Area for survey following beam-off.

C-AD Administrative Control Levels (ACLs)

Period	Maximum Individual Dose ACL	Individual Dose ACL with Line Authority Approvals
	(mrem)	(mrem)
Calendar Year	1000	1000 to 1250 (C-AD Chair Approval) 1250 to 2000 (Lab Director Approval)
Daily	100	100 to 200 (Approval will be on RWP)

C-AD Administrative Control Levels (ACLs)

Untrained Individuals, Visitors

25 mrem per year

A limit of 50 mrem per year is allowed with written permission from the C-AD Associate Chair for Safety and concurrence from the BNL Radiological Control Division.

Minors

25 mrem per year

Minor (< 18 years) dose limit is 25 mrem per year and parental consent is required. Minors are not allowed to work in radiological areas but are allowed to visit or tour radiological areas.

ALARA

RADIATION EXPOSURE MUST :

- Be AS LOW AS REASONABLY ACHIEVABLE
- Have A Net Benefit
- Be Within Limits

Basic ALARA strategy on the part of the worker (or User) revolves around effective use of Time, Distance and Shielding.

ALARA is applied most effectively at the design stage (e.g.: of a facility or of a piece of equipment).

Examples of ALARA strategies as it relates to operations and maintenance:

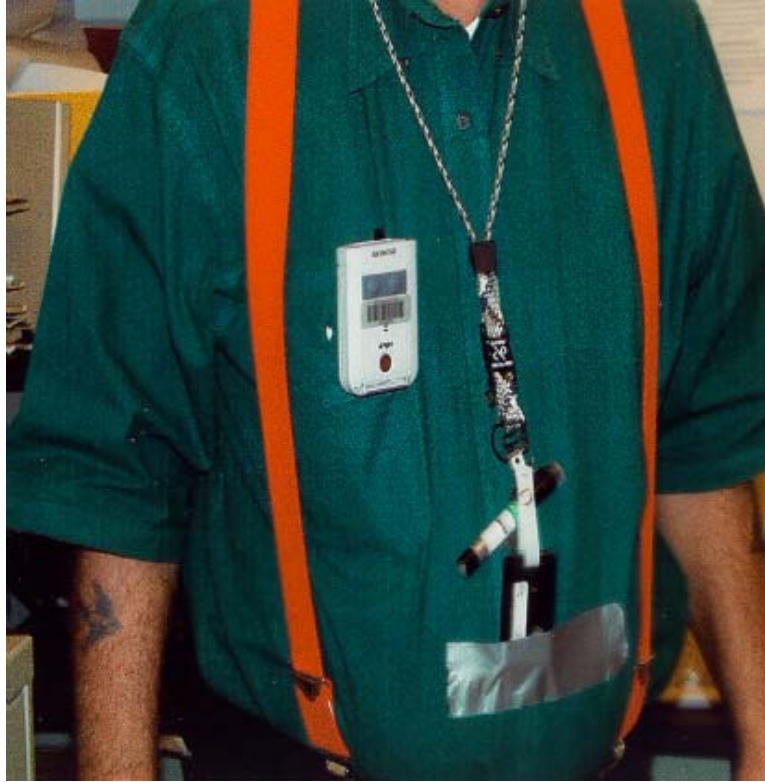
Tracking & reducing unnecessary beam losses

Using remote handling equipment

Planning work and practicing it outside a High Radiation Area

TLD BADGE RULES

Wear TLD on torso between neck and waste.



Return TLD to low background area



All TLDs have neutron badges; some could have an extra neutron pack for experimental runs in Bldg 912 to more accurately determine dose from neutrons

Red-Striped TLD badges for Visitors

The term “visitor” here means an “*untrained*” person.

- Visitors are not expected to do work in any area controlled for radiation protection
- A Red-striped TLD is issued to Visitors for a limited period and cannot be re-issued
- Red-striped TLDs are to be returned to their assigned badge board *EACH DAY*
- An Escort is required for a Visitor at all times when in the posted area



ABNORMAL RADIATION LEVELS

If you encounter any of the following then **STOP WORK**, leave the radiological area, alert your supervisor and contact Health Physics (x4660) as soon as possible:

- Radiation Levels not anticipated on your RWP
- Unexpected alarming or increased chirp rate of your self-reading dosimeter (SRD)

Take same action for a Lost or misplaced TLD or SRD
(stop work, leave area, alert supervisor & HP)

Radiation Barriers

When are you permitted to climb over or defeat barriers?

NEVER

Even if you believe the barrier is not needed, do not take it upon yourself to defeat the barrier. Contact the C-AD Health Physics Office or other safety personnel to have the barrier evaluated.

RADIATION SOURCES

Contact the C-AD Source Custodian if you are bringing a source to a C-AD area (even if being brought from another on-site BNL Department)

Have sources inventoried by C-AD Health Physics

Complete the source inventory form

Keep the inventory form with the source in the source box



Do not loiter around
source storage boxes

Some requirements for entering or working in Contamination Areas

- Complete the required Contamination Worker Training
- RWP required
- C-AD Radiological Control Tech (RCT) job coverage required
- Check/frisk all removed items, and yourself, for contamination
- Frisk at rate of 1 in/second

Note: An untrained individual may be escorted by a trained Contamination Worker into a Contamination Area (not to do work however).

An untrained individual cannot be escorted into a High Contamination Area.

CONTAMINATION

Examples of materials or activities that could be a contamination concern in C-AD radiological areas

- Leaking water from magnet cooling systems
- Drilling or grinding of materials in radiological areas
- Leaking oil from vacuum systems in primary areas
- The contents of fire extinguishers or gas cylinders that reside in primary areas during beam operations

Explosive Gas

For example: at STAR and PHENIX



YELLOW strobe and audible alarm

Note: Yellow strobe also used in some areas to indicate high ozone.
Same response: exit the area.

Magnetic Fields

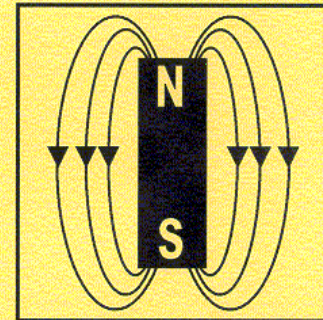


CAUTION

MAGNETIC FIELD HAZARD

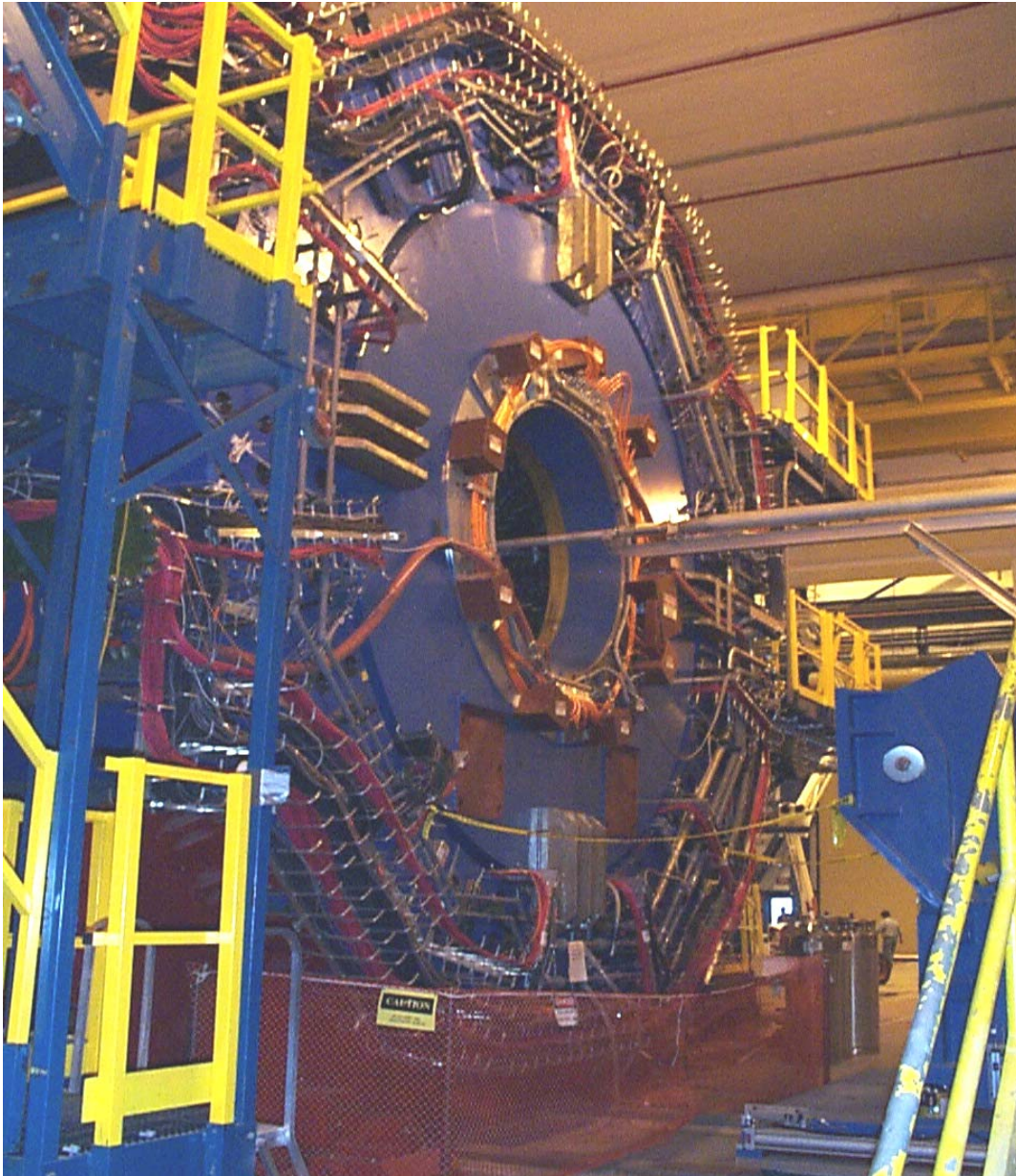
FIELDS $\geq 0.5 \text{ mT}$ (5 G)

- **MEDICAL EVALUATION AND TRAINING FOR USERS OF**
 - * **CARDIAC PACEMAKERS**
 - * **ELECTRONIC MEDICAL IMPLANTS**



SEE ES&H COORDINATOR FOR DETAILS

Magnetic Fields



Example: STAR magnet
in experimental hall.

High magnetic field
posting on fence

Hearing Protection



If entering a posted high noise area, as a minimum you are required to:

- wear hearing protection

AND

- complete a BNL web-based training course before entry (tells you how to properly insert ear plugs)

Medical surveillance (hearing test) may also be required depending on the decibel levels and length of time in areas.

Disposable ear plugs are located at the entrances to high noise areas.

Hardhat Policy



Required at construction areas

When people are working overhead

When overhead cranes are operating

Confined Space Recognition

A confined space is a space that: (even if not posted “Confined Space”)

1. Is large enough and so configured that personnel can bodily enter and perform assigned work;
2. Has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, and pits); and
3. Is not designed for continuous personnel occupancy.

If you are entering a space with these characteristics and:

- you are not sure of the requirements for entry,
- you are not sure of the requirements for working within the space, or
- you are introducing any hazard

THEN contact the ES&H Coordinator prior to entry.

Lead Hazard



**Contact ESH
Coordinator x4006 to
work with lead**

As a minimum:

- **No Bare Metal Handling**
- **Use Gloves**
- **Use Safety Shoes**

Electrical Safety

This C-AD Training does not alone qualify you to work on or near electrical equipment or circuits that are connected, e.g. powered through circuit breakers, disconnect switches and/or fuses.

Equipment/circuits should be LOTO'd (using your own lock). Additional training and authorization is required to perform LOTO.

Personal protective equipment (PPE) may also be required as well as a special work permit (Energized Electrical Work Permit).

Additional training and authorization is required for operation of circuit breakers or disconnect switches, and PPE is also required, even for relatively low voltage such as a 120 Volt breaker.

The training and PPE requirements at the Collider-Accelerator Department may be different and more conservative than the Laboratory-wide requirements.

Some contacts if you have questions regarding the electrical safety requirements for your specific situation are:

Your supervisor

The C-AD ESH Coordinator (x4006, pager 453-5940)

The C-AD ESHQ Division Head

The C-AD Work Control Manager

NEW Electrical Safety Requirements (NFPA 70E)

NFPA: National Fire Protection Association
70E: Electrical Safety in the Work Place

Newest Concern: ***Electrical Arc Flash Hazards***
(in addition to the better known concern of electrocution)

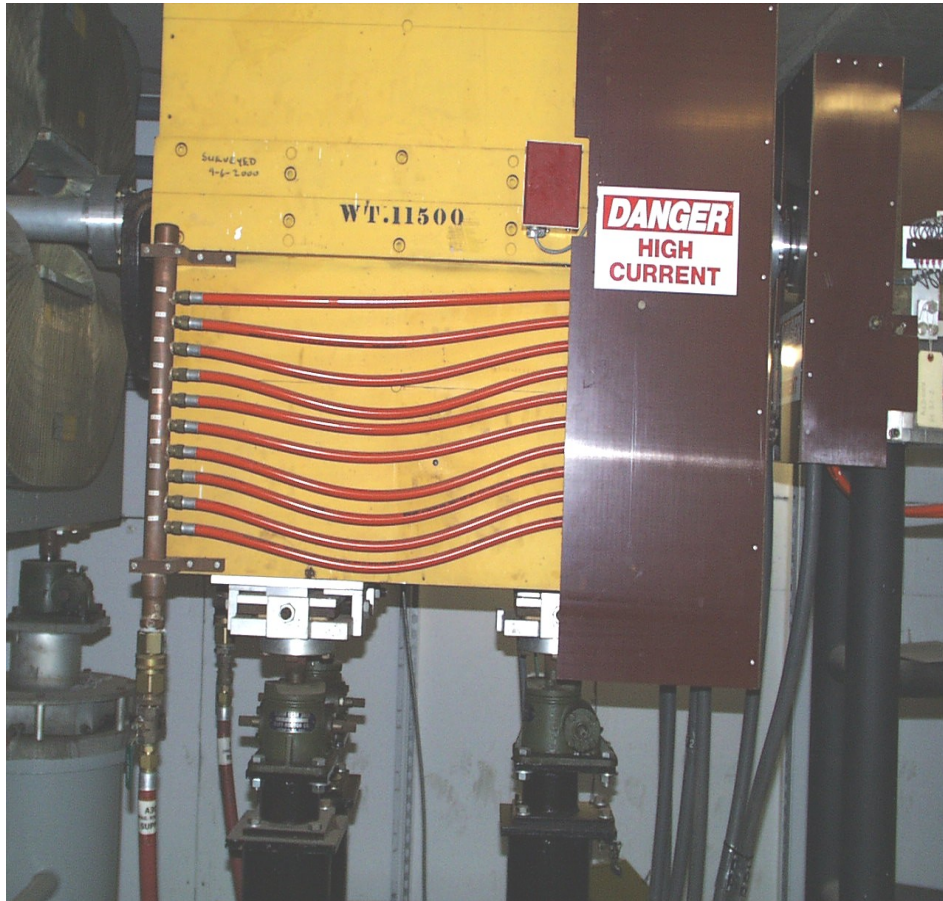
In U.S., 8 to 10 people per day are sent to burn unit due to arc flash, mostly from low voltage (120 V)

Biggest Impact to C-AD: Additional training & PPE required for breaker or switch gear operation

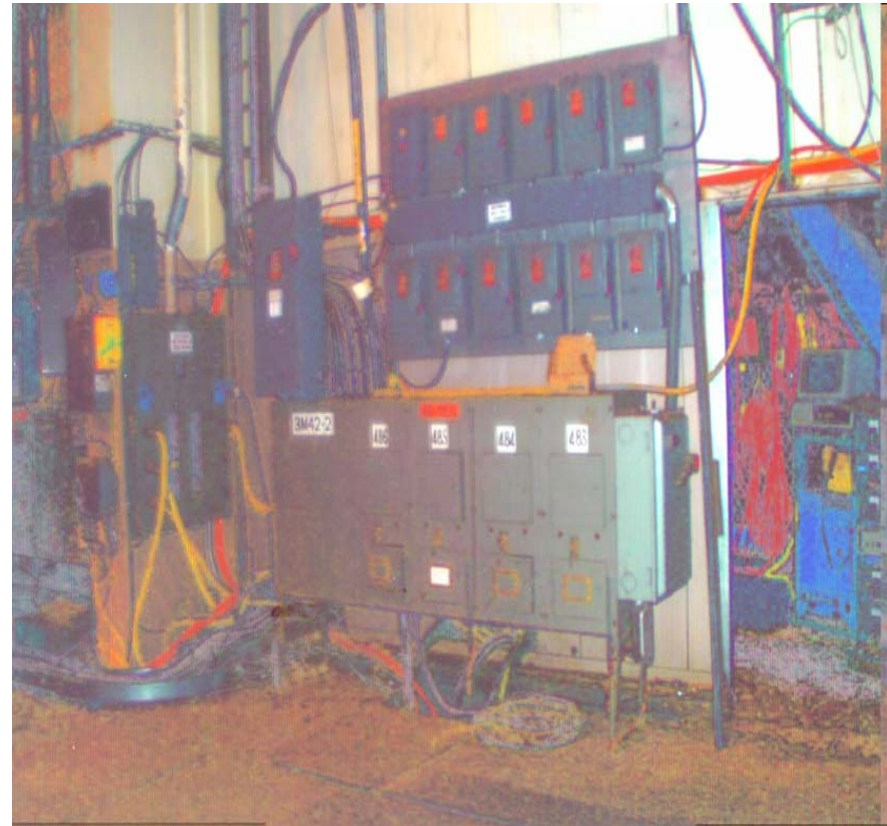
- Working on or near live equipment (including breaker/switch operation) is not permitted without the proper training & PPE
- This may slow jobs down, but we must comply with NFPA 70E

POTENTIAL FOR ELECTRICAL SHOCK HAZARD

Orange tubing typical for magnet cooling water



Magnet cooling water systems may incorporate electrical buses. The systems are operated under pressure and may have a radiation field associated with them and require special training to work on.



Some electrical panels may not be grounded.
Do not open panels without authorization!

DO NOT REMOVE BARRIERS !!!

without proper work planning





TAG NO. 66731

DATE _____ TIME _____

APPARATUS _____

HOLD DANGER

WRITE REASON IN SPACE BELOW

**DO NOT USE, MOVE OR OPERATE
WHILE THIS TAG IS ATTACHED**

TAG ATTACHED BY
AND MAY BE REMOVED ONLY BY

PRINT NAME	DEPT.	EXTENSION

RETURN TAG TO ISSUING
OFFICE WHEN NO LONGER REQUIRED

TAG NO. 66731 DATE _____

HAS BEEN ATTACHED TO _____

BECAUSE _____

SIGNED _____

RETURN STUB TO ISSUING OFFICE

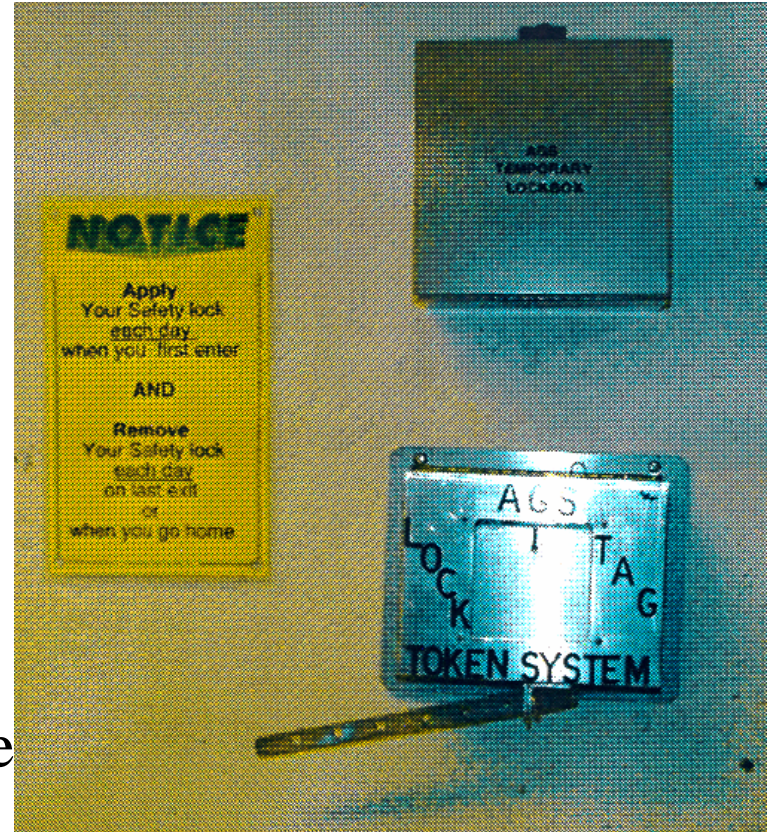
BNL F 2791A

LOTO

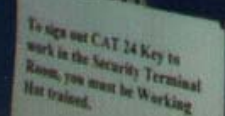
Used for
Personnel
Protection

ELECTRICAL SAFETY IN PRIMARY AREAS

- A single senior individual at C-A is responsible for the **TOKEN BOX**, and will be the first to place a lock and electrical safety red-tag on the **TOKEN BOX** and the last to remove it
- After LOTO is placed on the **TOKEN BOX**, **EACH WORKER ENTERING A RING MAY BE** required to place **THEIR OWN LOCK AND TAG** on the box as well
- The need for locking and tagging the box by each entrant **DEPENDS ON THE WORK** they are to perform
- Walk-through of the area where beam line **EQUIPMENT IS NOT TOUCHED** does not require the Radiation Worker to add their own lock and tag



Radiation Lock Out / Tag Out



“Orange” tags

An orange tag means the item or system is part of the Access Control System or the Particle Accelerator Safety System (PASS)



Program disruption will occur
by overlooking an orange tag.

Electric shock hazard possible
since most of system is 120 V.

CHIPMUNKS: Area Radiation Monitors



- Set up like a traffic light: Green, Yellow, Red
- RED: greater than 20 mrem/hour (approx)
- YELLOW: greater than 2.5 mrem/hour (approx)
- Data is stored and can be used to estimate personnel exposure
- Interlocks at high dose (trips off beam)

USE FOR EQUIPMENT PROTECTION

TAG NO. 1785

DATE _____

APPARATUS _____

**DO NOT
OPERATE**

THIS DEVICE SHALL NOT BE OPERATED BY ANY ONE
OTHER THAN THOSE DESIGNATED BY:

(SUPERVISORS OR FOREMEN)

UNAUTHORIZED OPERATORS ARE
SUBJECT TO DISCIPLINARY ACTION

(OVER)

CAUTION

DO NOT OPERATE

PROGRAMMATICAL LOSS
OR
EQUIPMENT DAMAGE
POSSIBLE

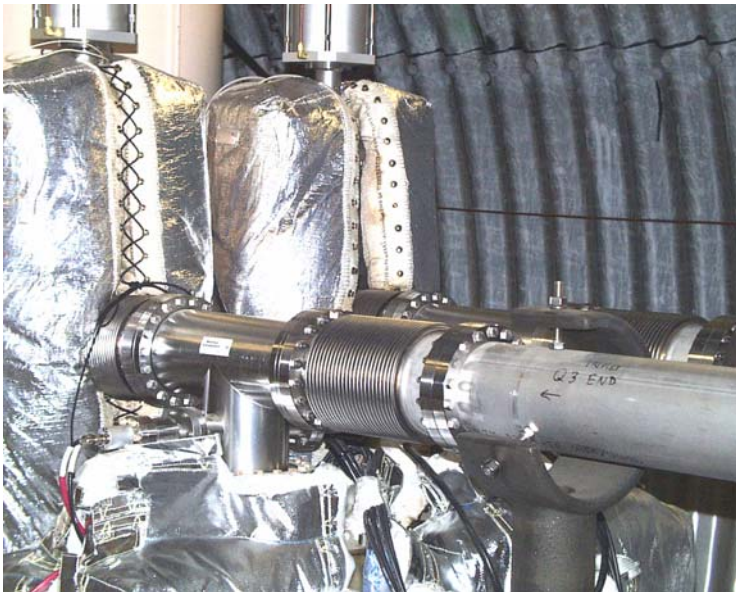
SEE OTHER SIDE.

STONEHOUSE SIGNS, Inc., Denver, CO
TAG NO. 2587-G

TRIP HAZARDS AT STAR



BEAM PIPES



LASERS



PIPING ELECTRICAL, WATER, CRYOGENIC



Deliveries at C-A

On-site

All persons, including delivery people, who enter Controlled Areas either must be escorted by a trained radiation worker or they must be a radiation worker (General Employee Radiological Training (GERT) required for “Controlled Areas”).

To ensure unauthorized delivery people do not wander into Controlled Areas when making deliveries on site, all deliveries are to be made to non-posted areas of the complex.

- Deliveries can be made to **Building 100**
- Deliveries for off hours can be arranged with the C-AD Main Control Room

Off-site

To ship material off the BNL site (other than printed documentation) material must go through one of the laboratory's special shipping divisions.

Checks may be required by: BNL Haz Waste Management Group
BNL Isotopes & Special Materials Group

Work Planning and Screening at C-AD

Work Permit (Green Form)

Review of conventional safety,
radiological safety, environmental
issues, work coordination

Qualified Work Control Coordinators
must screen all work

BROOKHAVEN
NATIONAL LABORATORY

Work Permit # _____
Work Order # _____
Job # _____ Activity # _____

I. Work requester fills out this section. ☐ **Standing Work Permit**

Requester _____ Date: _____ Ext. _____ Dept./Div/Group: _____
Other Contact person (if different from requester): _____ Ext. _____
Work Control Coordinator _____ Start Date _____ Est. End Date _____
Brief Description of Work: _____

Building _____ Room _____ Equipment _____ Service Provider _____

2. WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis.

ES&H ANALYSIS

Radiation Concerns ☐ None ☐ Activation ☐ Airborne ☐ Contamination ☐ Radiation ☐ Other _____
☐ Special nuclear materials involved, notify Isotope Special Materials Group ☐ Fissionable materials involved, notify Laboratory Criticality Officer

Safety Concerns ☐ None ☐ Ergonomics ☐ Transport of Haz/Rad Material ☐ Penetrating Fire Walls
☐ Adding/Removing ☐ Confined Space* ☐ Explosives ☐ Lead* ☐ Pressurized Systems
☐ Walls or Roofs ☐ Corrosive ☐ Flammable ☐ Magnetic Field* ☐ Rigging/Critical Lift
☐ Asbestos* ☐ Cryogenic ☐ Fumes/Mist/Dust* ☐ Material Handling ☐ Toxic Materials*
☐ Beryllium* ☐ Electrical ☐ Heat/Cold Stress ☐ Noise* ☐ Vacuum
☐ Biohazard* ☐ Elevated Work* ☐ Hydraulic ☐ Non-ionizing Radiation* ☐ Other _____
☐ Chemicals* ☐ Excavation ☐ Lasers* ☐ Oxygen Deficiency*
*Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? ☐ Yes ☐ No

Environmental Concerns ☐ None ☐ Work impacts Environmental Permit No. _____
☐ Atmospheric Discharges (rad/non-rad) ☐ Land Use ☐ Soil activation/contamination ☐ Waste-Mixed
☐ Chemical or Rad Material Storage or Use ☐ Liquid Discharges ☐ Waste-Clean ☐ Waste-Radioactive
☐ Cesspools (UIC) ☐ Oil/PCB Management ☐ Waste-Hazardous ☐ Waste-Regulated Medical
☐ High water/power consumption ☐ Spill potential ☐ Waste-Industrial ☐ Underground Duct/Piping
Waste disposition by: _____
☐ Other _____

Pollution Prevention (P2) / Waste Minimization Opportunity: ☐ None ☐ Yes

FACILITY CONCERNS ☐ None
☐ Access/Egress ☐ Electrical Noise ☐ Potential to Cause a False Alarm ☐ Vibrations
☐ Limitations ☐ Impacts Facility Use Agreement ☐ Temperature Change ☐ Other _____
☐ Configuration Control ☐ Maintenance Work on Ventilation Systems ☐ Utility Interruptions

WORK CONTROLS

Work Practices ☐ None ☐ Exhaust Ventilation ☐ Lockout/Tagout ☐ Spill Containment ☐ Security (see instruction sheet)
☐ Back-up Person/Watch ☐ HP Coverage ☐ Posting/Warning Signs ☐ Time Limitation ☐ Other _____
☐ Barricades ☐ IH Survey ☐ Scaffolding-requires inspection ☐ Warning Alarm (i.e. "high level")

Protective Equipment ☐ None ☐ Ear Plugs ☐ Gloves ☐ Lab Coat ☐ Safety Glasses
☐ Coveralls ☐ Ear Muffs ☐ Goggles ☐ Respirator ☐ Safety Harness
☐ Disposable Clothing ☐ Face Shield ☐ Hard Hat ☐ Shoe Covers ☐ Safety Shoes ☐ Other _____

Permits Required Permits must be valid when job is scheduled.
☐ None ☐ Cutting/Welding ☐ Impair Fire Protection Systems
☐ Concrete/Masonry Penetration ☐ Digging/Core Drilling ☐ Rad Work Permit-RWP No. _____
☐ Confined Space Entry ☐ Electrical Working Hot ☐ Other _____

Dosimetry/Monitoring ☐ None ☐ Heat Stress Monitor ☐ Real Time Monitor ☐ TLD
☐ Air Effluent ☐ Noise Survey/Dosimeter ☐ Self-reading Pencil Dosimeter ☐ Waste Characterization
☐ Ground Water ☐ O₂/Combustible Gas ☐ Self-reading Digital Dosimeter ☐ Other _____
☐ Liquid Effluent ☐ Passive Vapor Monitor ☐ Sorbent Tube/Filter Pump

Training Requirements (List below specific training requirements)

Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below.

ES&H Risk Level: ☐ Low ☐ Moderate ☐ High
Complexity Level: ☐ Low ☐ Moderate ☐ High
Work Coordination: ☐ Low ☐ Moderate ☐ High

If using the permit when all hazard ratings are low, only the following need to sign (although allowed, there is no need to use back of form)

WCC

DATE

Service Provider

DATE

Authorization to start
Departmental Sup/WCC/Designee

DATE

BNL F 3093C - rev. 9/03

Work Planning and Screening at C-AD

All jobs at C-AD must be screened by a qualified Work Control Coordinator for ES&H hazards. Hazard categories are:

Low Hazard Work: (Worker-Planned Work) Work requiring the attention of the average performer to prevent minor injury. Failure to correctly perform low-hazard work would not damage equipment or structures or release potentially hazardous materials to the environment, except as a result of gross negligence.

Requires *ENHANCED* Work Planning:

Moderate Hazard Work : Work requiring coordinated actions to prevent any injury to personnel, minor damage to equipment or structures, or release of hazardous materials to the on-site environment.

High Hazard Work: Work requiring coordinated actions to prevent serious injury to personnel, significant damage to equipment or structures, or releases of reportable quantities of potentially hazardous materials to the off-site environment.

Laser Safety

Lasers must be registered with the BNL Laser Safety Officer:

Includes higher hazard class lasers (Classes IIIb and IV) as well as lower hazard class lasers (Classes II and IIIa).

Classes IIIb and IV require:

- Additional Laboratory training
- Completion of a Laboratory Standard Operating Procedure (SOP).

Classes II and IIIa require a permit.

Contact: C-AD Laser Coordinator: Asher Etkin (x4006)

Oxygen Deficiency Hazard Training For Class “0” Areas

CAUTION

**OXYGEN
DEFICIENCY
HAZARD**

0

Prior to entry, all personnel shall have:

- Oxygen deficiency hazard orientation**

What Is Oxygen Deficiency?

Normal atmospheric content is:

20.9% oxygen, 78% nitrogen, 1% argon

Oxygen deficiency is defined as $< 19.5\%$ oxygen

This happens when air in an enclosed space is displaced by another gas (examples are helium and nitrogen)

What Causes Oxygen Deficiency?

- Cryogenic systems use large amounts of helium and nitrogen.
- Both liquids expand about 700-800 times when released in air.
- This could happen quickly with a major release as a result of a catastrophic failure. A rapidly expanding, white cloud and possible “whooshing” sound.
- Could be slow, invisible and silent leak.
- Both gases are colorless and odorless.
- Tandem Van de Graaff uses SF₆ gas

Classification of ODH Levels

- There are five classes: 0 through 4, with 0 being the least hazardous.
- Classification is based on the likelihood of fatality.
- This training only allows access into Class 0 areas at C-AD.
- Additional training and control measures are required for Class 1 Areas.
- There are no areas at the C-AD complex with classification greater than 1 (1005R refrigerator building is Class 1 when in operating mode)

ODH Class 0 Areas at C-AD complex

- Buildings at RHIC with Valve Boxes
 - Support Buildings 1002B, 1004B, 1006B, 1008B
 - Service Buildings 1010A and 1012A
- Collider Tunnel (except for STAR and PHENIX Intersection Regions)
- Helium Compressor Building 1005H
- Helium reliquifier section of Bldg 1005E
- AGS Tunnel if the Cold Snake is operating
- Tandem Van de Graaff (SF6)
- g -2 Compressor Building
- g-2 Muon Ring Storage Building (high bay)

CLASS 1 AREA AT RHIC

There is one Class 1 area at C-AD:

Bldg 1005R - RHIC Refrigerator Building

- Requires Additional Special Training
- Requires Medical Approval for entry
- Personal O₂ Monitor and Self-Rescue Escape Pack

Volume Oxygen (%)

Effect on Healthy Person (at Rest at Sea Level)

17	Increased breathing volume Accelerated heartbeat Night vision reduced
16	Dizziness Slower reaction time
15	Impaired attention Impaired judgment Impaired coordination Intermittent Breathing Rapid Fatigue Loss of muscle control
12	Very Faulty judgment Very poor muscular coordination (Inability to move) Loss of consciousness Permanent brain damage
10	Inability to move Nausea Vomiting
6	Spasmodic breathing Convulsive movements Death in 5 to 8 minutes

Effects of Oxygen Deficiency

Effects may occur rapidly

When Is Evacuation Required?

- When the in-place oxygen monitors set off an alarm.

At the COLLIDER: Blue Strobe Light & Audible Alarm



Note: In Bldg 1005H, RED strobe; no alarm

OR:

- A Vapor cloud is observed or a loud whooshing sound is heard inside the ODH area (even if no alarm sounds).

EVACUATION PROCEDURE

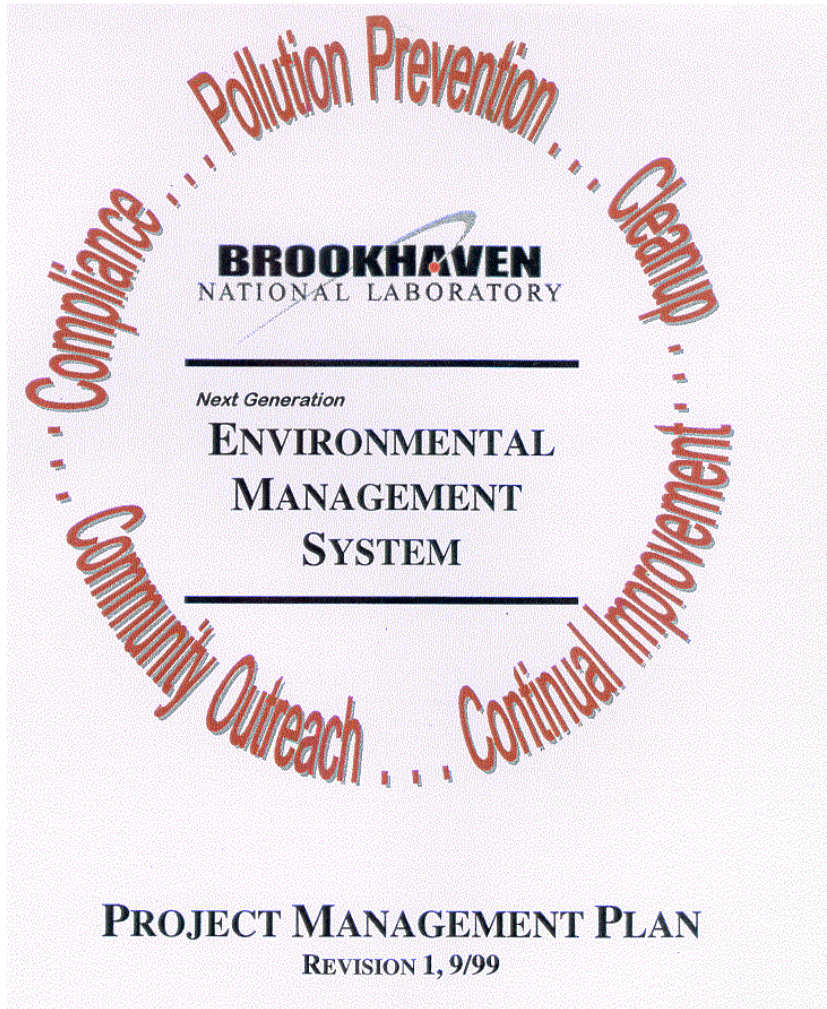
- Leave the area immediately, moving away from:
 - any vapor cloud (could be a lethal freezing hazard as well as ODH)
 - any noise (whooshing sound)
- If the gas is lighter than air such as Helium at RHIC, THEN stay low:
 - Duck under magnets to get to exits
 - Do not use overpasses to cross the beam lines
 - Do not use vertical (ladder) exits
 - Use only horizontal exits
- If the gas is heavier than air such as Sulfur hexafluoride (SF_6) used at the Tandem Van de Graff, THEN do not exit through low areas. Leave low areas immediately. Sulfur hexafluoride is a noncombustible, colorless gas, with a slight sulfur like odor.
- Call 2222 or 911 if anyone is injured or trapped.
- DO NOT ATTEMPT A RESCUE as you are likely to be the next victim! Let the pros handle it.

BNL Environmental Management System

International Standard ISO 14001

P2C4:

- **C**ompliance - Comply with all applicable environmental requirements
- **P**ollution **P**revention – Strive to prevent pollution, minimize wastes and conserve resources
- **C**leanup – Aggressively correct and clean up existing environmental problems.
- **C**ontinual Improvement – Protect our ecosystem and community by continually improving the way we manage our programs
- **C**ommunity Outreach – Openly communicate our progress and performance to our community and stakeholders



ESSH Policy Highlights

International Standard ISO 18001

ESSH: Environment, Safety, Security & Health



1. We are all responsible for safety
2. Consider the safety of others Integrate ESSH into our research and operations
3. Comply with BNL ESSH requirements
4. Reduce risks, conserve resources and prevent pollution
5. Assist stakeholders with their ESSH needs
6. Participate in community and government initiatives

SPILLS

- The C-A Department is required to report spills; internally, externally, or BOTH.
- C-AD must report *quickly* to external agencies on spills that impact the environment.
- Even minor events, such as spilling any amount of oil in an outdoor area, require reporting.
- If you spill any hazardous or industrial material outdoors on the ground, or anywhere inside and the spill is beyond your control, call x2222 or 911 to report the spill. Then call:

C-AD Main Control Room (x4662), the C-AD ESHQ Division Head (x5272) or the C-AD Environmental Coordinator (x7520).

- When reporting, give your name, and information on spill location, type of material and approximate amount (as best as you can).

Do not leave a message on an answering machine as notification.

WASTE DISPOSAL

Improper disposal of radioactive or hazardous/industrial waste may result in fines, criminal prosecution, and facility shutdown.

- Contact the C-AD Environmental Coordinator (x7520) for information on any waste.
- Contact the C-AD Environmental Compliance Representative (ECR x2905) prior to establishing any airborne, liquid, or solid radioactive or hazardous waste stream.

These individuals are familiar with rules, permits, authorizations and analysis requirements necessary for proper disposal.

Material Safety Data Sheets - MSDS

- Name of Chemical
- Manufacturer
- Hazardous Ingredients
- Physical Characteristics
- Fire and Explosion Data
- Reactivity Data
- Health Hazard Data
- Safe Handling Data
- Safety Control Measures

MSDSs are available from the:

- **C-AD ES&H Coordinator**
- **BNL Chemical Management System website database**

Compressed Gas Cylinder Handling

Reminder of general rules

Note: Additional Lab training required

- Do not drop cylinders or permit them to violently strike each other
- Do not roll cylinders in a horizontal position
- Do not drag cylinders
- Do not handle cylinders with oily hands or gloves (This is especially important when handling oxygen and other oxidizers)
- If hoisting is necessary, use a suitable cradle or platform
- Do not lift cylinder by its cap
- Keep cylinder caps on the cylinder whenever they are not in use
- Transport cylinders using a cart or hand truck designed for that purpose
- Whenever placing a cylinder in service, check the hydrostatic test date
- Tear off the bottom of the Cylinder Status Tag and write the name of assigned users on tag indicating the cylinder is in use.



10,...9,...8,...7,...”Houston, we have launch!

COMPRESSED GAS CYLINDER STORAGE

- Group Gas by Type, Separate Flammable from Oxidizers
- Empty Cylinders are to be Separate from Full
- Use approve carts for moving cylinders
- Secure cylinders to a permanent fixture or support



Summary of Alarm Signals

Orange Strobe and Audible Alarm

Beam Immanent — — — — — → Pull crash cord or exit through access gate, contact MCR

Blue Strobe and Audible Alarm

Oxygen Deficiency Hazard (ODH) — → Exit the area through horizontal exit, stay low

Yellow Strobe and Audible Alarm

Flammable or Explosive Gas — — → Exit the area, report to outdoor assembly area.
OR Ozone Alert

Continuous or Intermittent Bells

Fire — — — — — — — — — — → Exit the area, report to outdoor assembly area.

DO NOT RENTER buildings. Wait for further instructions from Fire Captain or ES&H Coordinator.

Emergency (Injury / Illness)

If there is an emergency such as an illness or injury, pull a fire alarm pull-box (if one is in the area) and call 911 or 2222. From a cell phone: 344-2222 (area code is 631).

If you are injured, report as soon as possible to the BNL Occupational Medicine Clinic (OMC), located in building 490.

❖ Please note the following lesson learned from an arc flash injury at STAR. This is not intended to imply any fault with the C-AD staff who participated in the emergency and acted as best as they saw fit at the time.

Unless an injury is very minor:

Never transport the injured person to the Clinic yourself; wait for the Fire Department to arrive with the EMT and ambulance. Make sure you pull the Fire Alarm box (if one is in the area) to immediately let Fire/Rescue know the location of the problem. Still follow up immediately with a call to 2222 or 911 (on a cell phone: 344-2222) to let F/R know it is an injury so the EMT/ambulance are dispatched to the scene (they usually don't send the ambulance for a fire only).

If you transport the person yourself, time may be wasted in having the ambulance track you down.

In addition, you may be stuck with an injured person who passes out or stops breathing, etc., on the way to the Clinic or you could be nervous and have an accident on the way to the Clinic.

For a minor non-emergency injury, report as soon as possible to the BNL Occupational Medicine Clinic (OMC), located in building 490.



C-AD Escort Policy

CONTACT C-AD ESHQ Division:

John Maraviglia (x7343)

or

Ray Karol (x5272)

or

Asher Etkin (x4006)

Note Your Surroundings

- Exits
- Fire Alarm Pull Boxes
- Intercoms / Telephones
- TLD Requirements
- Conventional Safety Hazards/Postings
- Radiological Safety Hazards/Postings
- Safety Equipment
- Emergency exhaust
- Assembly Areas

Staffing Levels and Safety

- Rules shall be followed even when you are short-handed.
- Do not violate Safety Rules to get the job done.
- Do not use a procedure that you have not been trained on even if you feel it will please your supervisor.



Disciplinary Action

C-AD Procedure 1.26: C-AD Standards for Disciplinary Action

The BNL SBMS Subject Area on Disciplinary Actions
(https://sbms.bnl.gov/Sbmsearch/subjarea/147/147_exh1.cfm),
and its categories of
significant, major and minor offenses, will be followed.

Details on the following slide . . .

Disciplinary Action (continued)

Criminal acts:

1) While at work, physical or verbal assault, theft or stealing any material or property with the intent to keep, sell or use it for personal gain, will result in immediate termination

Significant offenses:

2) *Willful* failure to adhere to or follow RSLOTO, LOTO or Orange Tag Procedures in C-AD OPM Chapters 1, 2, 7 or 9

3) *Willful* violation of radiation safety requirements

4) Fighting or creating a disturbance that causes injury to others; applies to the aggressor only

Major offenses:

5) Failure to adhere to or follow property protection rules in [C-AD OPM 1.20](#)

6) Failure to report lost or stolen keys for a secured area or equipment; duplicating a key made for a secured area or equipment

7) Demonstrating a carelessness or indifference to rules regarding sexual harassment, discrimination and computer security

Minor offenses:

8) Failure to wear personal protective equipment while performing work requiring this equipment; if injury occurs, then major offense

9) Not meeting or maintaining training requirements listed in your Job Training Assessment

Traffic violations and failure to follow safety or security postings:

10) Traffic violations constitute safety infractions and could be cause for disciplinary action. Safety or security postings, whether temporary or permanent, *must* be followed by all managers, supervisors and workers. These violations would be categorized as minor, and a graded approach would be used to determine major or significant offenses. In the case of repeat offenders, the length of time between violations would be considered.